

Introduction

This water quality monitoring fact sheet was prepared by the Irrigated Agriculture Program of the Central Coast Regional Water Quality Control Board (Water Board) and made available on November 30, 2008. The data were delivered by Central Coast Water Quality Preservation, Inc. (CCWQP) to the Water Board as part of the monitoring and reporting requirements for all dischargers enrolled under *Conditional Waiver of Waste Discharge Requirements for Discharge from Irrigated Lands, Order No. R3-2004-0117*. Monitoring stations were selected to represent water quality in predominantly agricultural areas, but in some cases reflect mixed land uses upstream of the sites.

312OFC Oso Flaco Creek at Oso Flaco Lake Road

The Cooperative Monitoring Program sampled Oso Flaco Creek at Oso Flaco Lake Road 35 times (one sample per month) between February 2005 and December 2007.

Summary of Water Quality Data

Notable Measured Analytes for Water Quality Monitoring

Analyte/Parameter	Average	Range	Water Quality Criteria (WQC) or Guideline ¹	Percent Outside WQC or Guideline
Ammonia as N, Unionized	0.015 mg/L	0.001–0.148 mg/L	<0.025 mg/L ⁺	14%
Nitrate/Nitrite as N	38.8 mg/L	2.9–63.7 mg/L	<10.0 mg/L ⁺	93%
Orthophosphate as P	0.22 mg/L	0.00–1.11 mg/L	<0.12 mg/L*	69%
Turbidity (NTU)	430 NTU	26–3000 NTU	<25 NTU*	100%
Conductivity	1.98 mmho/cm	0.00–2.94 mmho/cm	Ranges: ⁺ <0.75 No Problem 0.75–3.0 Increasing >3.0 Severe	6% 94% 0%
pH	7.7	7.3–8.1	7.0–8.3 ⁺	0%
Annual Median Dissolved Oxygen (% Saturation)	2005: 93% 2006: 96% 2007: 93%	80–113%	>85% annual median ⁺	Std met Std met Std met
Dissolved Oxygen	9.3 mg/L	7.3–11.5 mg/L	>5.0 mg/L (GEN/ WARM) ⁺ >7.0 mg/L (COLD/SPWN)*	0% 0%
Chlorophyll a	2.8 µg/L	0–21.7 µg/L	<40 µg/L*	0%
Water Temperature	15.7°C	10.6–22.2°C	Water Basin Specific	--

+ Indicates standard defined in the Water Quality Control Plan, Central Coast Basin (Basin Plan)

* Indicates guideline not described in the Basin Plan or not specifically stated as applicable to the beneficial uses of the site. Origin of the guideline is described in the individual discussion of the analyte/parameter.

The present and potential beneficial uses for **Oso Flaco Creek** include Municipal and Domestic Supply (MUN), Agricultural Supply (AGR), Ground Water Recharge (GWR), Water Contact Recreation (REC-1), Non-Contact Water Recreation (REC-2), Wildlife Habitat (WILD), Warm Fresh Water Habitat (WARM), Preservation of Biological Habitats of Special Significance (BIOL), Rare, Threatened, or Endangered Species (RARE), Freshwater Habitat (FRESH) and Commercial and Sport Fishing (COMM).

¹ Water Quality Criteria (WQC) are defined in the Water Quality Control Plan, Central Coast Basin (also referred to as the “Basin Plan”) to protect beneficial uses such as drinking water, fish habitat, irrigation water, etc. WQC include general water quality standards for some analytes as well as specific criteria based on the defined beneficial uses. Other water quality guidelines were compiled to provide a standard in order to compare sites. Bold indicates beneficial uses that apply to this watershed.

Unionized Ammonia (as N)

Unionized ammonia (as N) is a calculated value based on water temperature, pH, and total ammonium concentration. Ammonia can be toxic in water. With high water temperature and/or high pH, ammonia becomes unionized and is toxic at much lower levels. The Basin Plan general water quality objectives state that unionized ammonia should not exceed 0.025 mg/L. Over time, ammonia should reduce to nitrate, so long-lasting levels of ammonia may indicate continuous discharges of waste. **Five of 35 samples (14%) exceeded the standard. All exceedances occurred during or after July 2006. The average unionized ammonia concentration was 0.015 mg/L.**

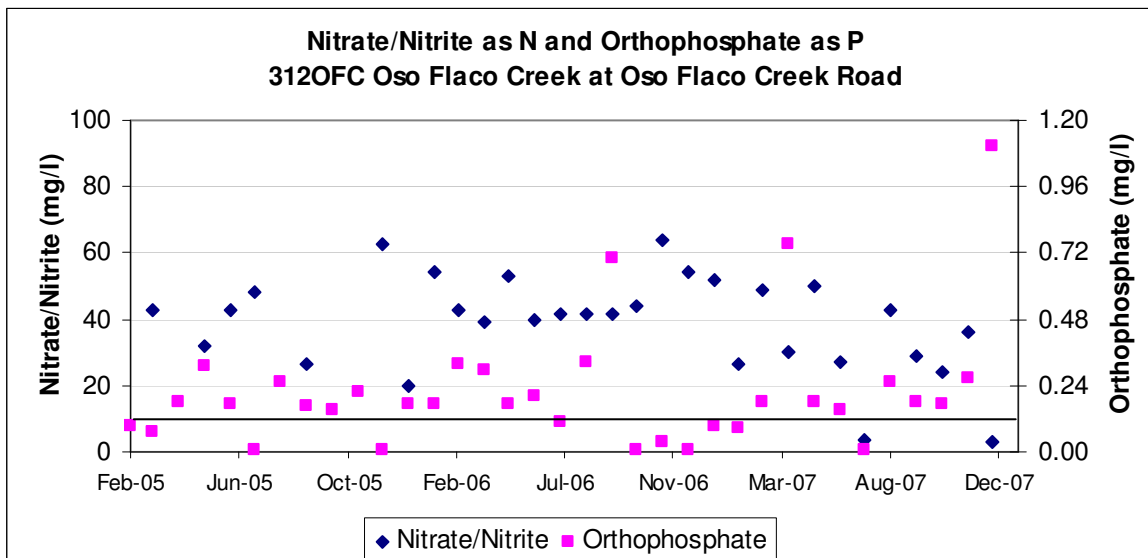
Nitrate/Nitrite as N

The Municipal and Domestic Supply (MUN) objective states in Table 3-2 of the Basin Plan that nitrate as NO_3 shall not exceed 45 mg/L. This value is equivalent to 10 mg/L of nitrate as N. Nitrite accounts for a small percent of total nitrate/nitrite, and therefore, nitrate as N criterion was used as a guideline for nitrate/nitrite. **Twenty-eight of 30 nitrate/nitrite samples (93%) exceeded the guideline. The two samples that were at acceptable concentrations occurred in 2007 (July and December). The average concentration was 38.8 mg/L, with a range from 2.9 to 63.7 mg/L (six times the guideline).**

Orthophosphate as P

The Basin Plan does not contain orthophosphate standards. The Central Coast Ambient Monitoring program (CCAMP) non-regulatory guideline for general water quality objectives states that orthophosphate concentrations shall not exceed 0.12 mg/L. **Orthophosphate concentrations exceeded the guideline in 24 of 35 samples (69%), with the three highest exceedances occurring during or after September 2006. The average concentration was 0.22 mg/L.**

The chart below shows the nitrate/nitrite and orthophosphate concentrations throughout the sampling period. The guidelines for nitrate/nitrite as N and orthophosphate as P state that their concentrations shall not exceed 10 mg/L and 0.12 mg/L, respectively, shown by the black horizontal line on the graph.



Turbidity

The Basin Plan states: “Water shall be free of changes in turbidity that cause nuisance or adversely affect beneficial uses.” Sigler et al.² shows that turbidity levels of 25 NTU or greater caused reduction in juvenile salmonid growth due to interference with their ability to find food. Turbidity is often affected by suspended material in runoff. **All 35 turbidity readings exceeded the guideline. Turbidity levels in Oso Flaco Creek at Oso Flaco Lake Road averaged 430 NTU, and ranged from 26 NTU to greater than 3000 NTU. All samples exceeded the standard; five by more than 35 times and one by more than 120 times. This means that during that sampling, the water would need to be diluted in a water body more than 120 times its size in order to provide water that would not impair fish.**

² Sigler, J.W., T.C. Bjornn, & F.H. Everst. (1984). *Effects of chronic turbidity on density and growth of steelhead and coho salmon*. Transactions of the American Fisheries Society. 113:142-150.

Conductivity

Conductivity is measured from a water sample. Based on Table 3-3 of the Basin Plan showing Guidelines for Interpretation of Quality of Water for Irrigation, conductivity below 0.75 mmho/cm causes no problems to irrigation, between 0.75 and 3 mmho/cm causes increasing problems, and conductivity above 3 mmho/cm causes severe problems. The conductivity level can be greatly affected by geologic and biological influences and is not necessarily related to agricultural activities. **Two of 35 conductivity samples (6%) indicated no problems to irrigation water; 33 samples (94%) indicated increasing problems; no samples indicated severe problems.**

pH

Multiple beneficial uses have objectives for pH. The Basin Plan general water quality objective for pH is between 7.0 and 8.5; MUN, AGR, REC-1, and REC-2 pH objectives are between 6.5 and 8.3. The standard, therefore, is 7.0-8.3 if one or more of MUN, AGR, REC-1, and REC-2 is defined as a beneficial use. pH above 9 can cause skin irritant to humans and makes water inhospitable to many species. **All 35 samples remained within the standard for pH, ranging from 7.3 to 8.1.**

Dissolved Oxygen Concentration and Dissolved Oxygen Saturation

The Basin Plan general water quality objectives state annual median dissolved oxygen shall remain above 85% saturation. General and WARM objectives state that the dissolved oxygen concentration must remain above 5.0 mg/L at all times, and SPWN and COLD objectives state that the dissolved oxygen concentration must remain above 7.0 mg/L at all times. **All 35 samples met the general and WARM and the COLD and SPWN concentration standards. Dissolved oxygen met the saturation standard during 2005, 2006 and 2007, with median annual values of 93, 96, and 93 % saturation, respectively.**

Chlorophyll a

Healthy and appropriate Chlorophyll a levels are not defined in the Basin Plan. Chlorophyll a indicates phytoplankton growth, a necessary component of healthy water bodies. Because turbidity causes interference for the Chlorophyll a probe, measurements of Chlorophyll a may not be accurate when turbidity is above 1000 NTU. Chlorophyll a levels over 40 µg/L are considered problematic by North Carolina Administrative Code (NCAC). **No readings exceeded the guideline. The Chlorophyll a readings averaged 2.8 µg/L.**

Temperature

Sullivan et al.³ states that the maximum weekly average temperatures for protection of steelhead or rainbow trout, and coho salmon are 19.6 and 19.7°C respectively. **The temperature averaged 15.7°C and ranged from 10.6 to 22.2°C. Though weekly averages were not taken, and Oso Flaco Creek is designated a warm-water creek, the temperatures taken at this site indicate that it may be capable of supporting a cold-water fish habitat.**

³ Sullivan, K., D.J. Martin, R.D. Cardwell, T.E. Toll, & S. Duke. (2000). *An analysis of the effects of temperature on salmonids of the Pacific Northwest with implications for selecting temperature criteria*. Portland, OR: Sustainable Ecosystems Institute.

Summary of Toxicity Data

Species with Significant Mortality

	Feb-05	Mar-05	Apr-06	Jul-05	Sep-05	Feb-06	May-06	Aug-06	Sep-06	Feb-07	Mar-07	Apr-07	Oct-07
Invertebrate (Water Column)	No	No*		Yes	Yes ⁺	No*		Yes ⁺	No	Yes	No		No*
Invertebrate (Sediment)			Yes				Yes					No*	
Fish (Water Column)	No	No				No		No	No	No	No		No
Algae (Water Column)	No	No				Yes		No	No	Yes	Yes		No

⁺Indicates complete mortality within 24 hours of test initiation

*Indicates significant effect on growth or reproduction (even though mortality did not have a significant effect)

Significant effect is determined by statistically significant rates of mortality, growth, or reproduction compared to a control sample and provides an indication that something is affecting plant or animal life in the stream. Invertebrates show significant sensitivity to organophosphates and pesticides. Significant effect to algae often indicates the presence of herbicides and metals such as copper. Fish are less sensitive to organophosphates but can be impacted by other pollutants such as ammonia and pyrethroid pesticides.

Photos of Site



July 2006



February 2006

QAQC

The data in this water quality monitoring fact sheets meet the quality assurance and quality control requirements of the Water Board's Surface Water Ambient Monitoring Program (SWAMP). Additional surface water monitoring data are available at the Water Board's Central Coast Ambient Monitoring Program website <http://www.ccamp.org>. Any questions regarding the data or analysis should be directed to either **Peter Meertens** at pmeertens@waterboards.ca.gov (805) 549-3869 or **Amanda Bern** at abern@waterboards.ca.gov (805) 594-6197.

Attachment: Monitoring Data

Site/Tag	Oso Flaco Creek at Oso Flaco Lake Road													
312 OFC	Beneficial Uses: MUN, AGR, GWR, REC1, REC2, WILD, WARM, BIOL, RARE, FRESH, COMM													
		Ammonia as N, Unionized	Chlorophyll a	Conductivity	Instantaneous Flow	Nitrate/Nitrite as N	N/N / STD	Orthophosphate as P	OP / STD	Oxygen, Dissolved	Oxygen, Saturation	pH	Turbidity	Water Temp
Units		mg/L	µg/L	mmho/cm	CFS	mg/L	none	mg/L	none	mg/L	%		NTU	°C
2/21/2005	Feb-05	0.0023	21.73	1.226	8.6			0.093	0.8	9.07	91	7.63	428	15.2
3/22/2005	Mar-05	0.0056	8.32	2.493	2.2	42.8	4.3	0.070	0.6	9.15	89	7.75	196	14.0
4/19/2005	Apr-05	0.0051	2.17	2.662	6.1			0.181	1.5	11.46	104	7.37	232	10.8
5/24/2005	May-05	0.0121	1.04	1.612	6.9	32	3.2	0.310	2.6	9.49	95	7.87	260	15.2
6/21/2005	Jun-05	0.0016	1.71	2.08	5.9	43	4.3	0.170	1.4	8.95	89	7.48	66	14.8
7/26/2005	Jul-05	0.0125	1.71	2.08	4.8	48	4.8	0.004	0.0	8.95	89	7.48	66	14.8
8/31/2005	Aug-05	0.0018		2.041	3.2			0.254	2.1	9.07	101	7.58	39	20.1
9/27/2005	Sep-05	0.0034	2.15	1.777	3.2	26.4	2.6	0.166	1.4	9.59	95	7.54	313	14.6
10/25/2005	Oct-05	0.0018	1.12	2.661	0.9			0.154	1.3	8.9	89	7.40	46	14.9
11/29/2005	Nov-05	0.0021	1.43	1.666	3.1			0.217	1.8	10.1	97	7.84	122	13.5
12/15/2005	Dec-05	0.0009	1.56	2.195	1.7	62.7	6.3	0.004	0.0	10.29	93	7.30	26	10.6
1/26/2006	Jan-06	0.0065	3.22	1.844	1.5	19.9	2.0	0.175	1.5	9.94	97	7.90	1580	14.1
2/23/2006	Feb-06	0.0007	0.77	2.9	0.9	54	5.4	0.177	1.5	10.22	96	7.41	30	11.8
3/29/2006	Mar-06	0.0042	10.88	1.933	1.6	42.8	4.3	0.316	2.6	10.9	110	7.93	106	15.0
4/27/2006	Apr-06	0.0024	4.85	1.825	2.2	39.1	3.9	0.293	2.4	9.3	91	7.58	205	14.4
5/15/2006	May-06	0.0045	1.66	2.063	1.9	53	5.3	0.175	1.5	8.88	98	8.05	47	20.0
6/28/2006	Jun-06	0.0013	1.86	2.124	3.0	40	4.0	0.203	1.7	11.01	113	7.48	54	16.0
7/27/2006	Jul-06	0.0402	1.75	1.87	4.5	41.6	4.2	0.110	0.9	9.28	106	7.67	3000	20.5
8/23/2006	Aug-06	0.0023	1.16	1.878	4.6	41.5	4.2	0.322	2.7	8.37	87	7.70	40	16.6
9/26/2006	Sep-06	0.0339	0.93	2.015	2.7	41.7	4.2	0.700	5.8	8.8	96	7.99	113	19.2
10/25/2006	Oct-06	0.0178	1.61	1.897	5.1	44.2	4.4	0.004	0.0	9.34	100	8.08	383	18.4
11/15/2006	Nov-06	0.0020	0.75	2.644	0.9	63.7	6.4	0.038	0.3	8.19	83	7.51	41	15.4
12/14/2006	Dec-06	0.0125	0.005	2.942	0.6	54	5.4	0.004	0.0	9.5	95	7.68	41	15.0
1/31/2007	Jan-07	0.0056	4.96	2.78	0.7	52	5.2	0.092	0.8	8.41	80	7.55	29	12.5
2/14/2007	Feb-07	0.0021	0.005	2.371	1.2	26.7	2.7	0.089	0.7	10.47	104	7.89	305	15.4
3/20/2007	Mar-07	0.0125	3.13	1.924	4.1	48.8	4.9	0.178	1.5	9.19	92	7.72	272	15.2
4/11/2007	Apr-07	0.1480	5.59	1.719	4.8	29.9	3.0	0.752	6.3	9.98	107	8.11	983	18.1
5/29/2007	May-07	0.0090	0.7	2.283	1.0	50.1	5.0	0.182	1.5	8.45	92	7.70	79	19.2
6/27/2007	Jun-07	0.0288	2.47	0.0008	5.3	27.2	2.7	0.151	1.3	8.86	94	7.93	1553	18.0
7/26/2007	Jul-07	0.0198	0	1.961	4.2	3.6	0.4	0.004	0.0	8.11	86	7.72	210	17.1
8/29/2007	Aug-07	0.0152	2.2	1.882	3.3	43	4.3	0.254	2.1	7.33	85	7.68	436	22.2
9/26/2007	Sep-07	0.0129	0	2.169	3.2	29	2.9	0.182	1.5	8.02	89	7.47	81	20.0
10/25/2007	Oct-07	0.0091	0.99	1.597	4.7	24	2.4	0.175	1.5	9.59	93	7.79	218	13.6
11/29/2007	Nov-07	0.0762	1.18	1.757	2.6	36.1	3.6	0.269	2.2	10.12	94	8.05	436	11.9
12/18/2007	Dec-07	0.0198	2.98	0.5757	7.6	2.88	0.3	1.108	9.2	9.78	93	7.92	3000	13.0
Average		0.015	2.8	1.98	3.4	38.8		0.22		9.3	Below	7.7	430	15.7
Standard Deviation		0.027	4.1	0.58	2.1	14.7		0.22		0.9		0.2	743	2.9
Minimum		0.001	0.0	0.00	0.6	2.9		0.00		7.3	80	7.3	26	10.6
Maximum		0.148	21.7	2.94	8.6	63.7		1.11		11.5	113	8.1	3000	22.2
Standard		<0.025	<40	<0.75		<10		<0.12		>5		7-8.3	<25	
%Outside		14%	0%	6%		93%		69%		0%		0%	100%	
Standard 2				3		Median Annual DO %				>7				
%Outside				0		Year	Median	Meet Criteria		0%				
						2005	93%	Yes						
						2006	96%	Yes						
indicates times exceeding standard						2007	93%	Yes						